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Subject: Insect and Disease Conditions in Mt. Eldon section of the Eastside Fuel Reduction and Forest Health Project

To: Andrew Stevenson, Silviculture, Flagstaff Center, Peaks Ranger District

This letter describes the affected environment, general biology/ecology, and environmental effects relative to southwestern dwarf mistletoe infection in two stands on Mt. Elden Lookout Road, which are part of the Eastside Fuel Reduction and Forest Health Project. An assessment of aspen health is also included.

Affected Environment

The two stands, 297-01 and 297-02, comprise 300 acres and are adjacent to one another along the western base of Mt. Eldon. They are densely forested stands dominated by ponderosa pine, with scattered gambel oak and juniper. The pine is dispersed in groups of various size classes, with most in mid to larger size classes. Southwestern dwarf mistletoe infection in these sites is fairly high, although patchy, with some groups with little or no mistletoe infection. Regeneration has been impacted in some areas from dispersal of dwarf mistletoe seed from infected overstory trees (Figure 1).

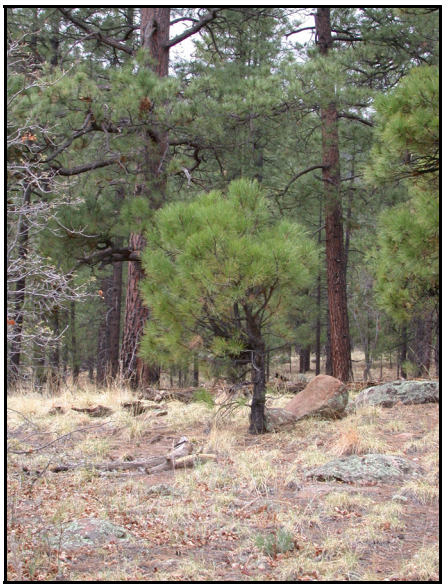

Figure 1. Southwestern dwarf mistletoe infection has impacted the growth & form of this younger tree.

Stand 297-02 has a lot of small aspen clones spread throughout the stand, especially in rocky outcrops. Most of the mid- to over-story aspen died within the past 3-5 years, due to a combination of the extreme drought of the past 10 years and secondary agents (e.g. cytospora canker and aspen poplar borer). Although it was apparent aspen was sprouting after death of the overstory (Figure 2), ungulate browsing was obvious (Figure 3).

Figure 2 Aspen sprouting occurred following death of mid- and over-story trees.

Figure 3 Aspen sprout browsed by deer or elk.

Dwarf Mistletoe Biology/Ecology

Dwarf mistletoes are parasitic, seed-bearing plants that depend on their hosts almost completely for water and nutrients. They are natural components of many forest ecosystems in the West. They provide forage for many species of birds and mammals, and the witches' brooms they cause serve as excellent nest sites. As parasites, dwarf mistletoes cause significant changes in physiological processes and structural characteristics of infected trees that result in changes in the structure and function of forest communities.[1, 2] Infected host trees are slowly weakened and eventually killed as the dwarf mistletoes drain them of water and nutrients. Overall effects on forest structure in a site which has been infected for many generations include: increased number of stand openings; lower crown canopy; denser canopy due to witches' brooms; and fewer large diameter trees.

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[1] Parmeter, J.R., Jr. 1978. Forest stand dynamics and ecological factors in relation to dwarf mistletoe spread, impact, and control. P. 16-30, In: Proceedings of the symposium on dwarf mistletoe control through forest management. Robert F. Scharpf and John R. Parmeter, Jr., Tech. Coords., April 11-13, 1978, Berkeley, CA: USDA Forest Service General Technical Report PSW-31, 190 p.

[2] Tinnin, R.O. 1984. The effect of dwarf mistletoe on forest community ecology. P. 117-122, In: Biology of Dwarf Mistletoes: Proceeding of the Symposium. Frank G. Hawksworth and Robert F. Scharpf, Tech. Coords., August 8, 1984, Ft. Collins, CO: USDA Forest Service General Technical Report RM-111, 131 p.

Survival of the host is influenced by the severity of dwarf mistletoe infection and site factors. Hawksworth and Geils[3] determined 32-year survival rates of tagged ponderosa pines with various intensities of dwarf mistletoe infection at Grand Canyon National Park, AZ. While more than 90% of the uninfected and lightly infected trees survived the 32-year period, only 5% of the heavily infected trees over 9 in. dbh and none of those in the 4-9 in. dbh class survived. Heavily infected trees are frequently attacked by secondary bark beetles, which hasten their death.

Dwarf mistletoes have a fairly complicated and long life cycle. Seeds of dwarf mistletoes are explosively released and expelled to distances typically ranging from 10 to 40 feet. Infection takes place through the bark on needle-bearing portions of twigs. Dwarf mistletoes first produce an endophytic system, a specialized rootlike structure that is in contact with the phloem and xylem of host trees, from which the parasite obtains most of its nutrients and water. Aerial shoots appear between 2 to 5 years after infection; fruit development occurs two to three years later. The period of infection before shoots are visible is known as the latent period.

Spread of dwarf mistletoe is a function of stand structure, density, age, and site index. Spread from overstory to understory is the most rapid, because it is multidimensional. Initially, all infections in the young stand develop directly from seeds produced from overstory trees. Then there is a transition period when infections in the young stand begin to produce seeds that further infect the stand. Subsequently, infection in the young stand progresses outward beyond the range of the seeds produced in the overstory stand. Spread through even-aged stands, beyond the limit of seed from an overstory source, is termed **lateral spread**.

Researchers[4, 5] measured the distance of infected seedlings from the source of overstory trees at different time intervals. In stands about 20 years old, nearly all infection was found to be attributable to seed produced in the overstory with 80 percent of infected seedlings within 35 feet of the infected overstory trees. In 50-year-old stands, lateral spread accounted for about one-half of the spread in open stands and one-third of the total in dense stands, with distances from the original overstory seed source reaching nearly 80 feet and 65 feet, respectively.

Wildfires are probably one of the primary ecological factors in determining the distribution and intensity of dwarf mistletoes in unmanaged coniferous forests. Relatively complete burns tend to have a sanitizing effect on infected stands, while partial burns can lead to rapid infection of regeneration, if scattered infected trees remain following the fire. Two studies that evaluated the interaction of fire and dwarf mistletoe on mortality of southwestern ponderosa pine following prescribed burning[6, 7] found, although to different degrees, heavily infected trees had reduced survival rates compared to lightly infected or non-infected trees.

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[3] Hawksworth, F.G. and B.W. Geils. 1990. How long do mistletoe-infected ponderosa pines live? West. J. Appl. For. 5(2): 47-48.

[4] Gill, L.S. and F.G. Hawksworth. 1954. Dwarfmistletoe control in southwestern ponderosa pine forests under management. Jour. Forestry 52: 347-353.

[5] Hawksworth, F.G. 1961. Dwarfmistletoe of ponderosa pine in the Southwest. Tech. Bull. 1246. USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station. 13p.

[6] Alexander, M.E. and F.G. Hawksworth. 1976. Fire and dwarf mistletoes in North American coniferous forests. Jour. Forestry. 74 (7): 446-449.

[7] Conklin, D.A. and W.A. Armstrong. 2001. Effects of three prescribed fires on dwarf mistletoe infection in southwestern ponderosa pine. USDA Forest Service, Southwestern Region, Forestry and Forest Health. R3-01-02. 17 p.

Silvicultural Control Options for Dwarf Mistletoe

The impacts of dwarf mistletoe infection were once based on variables relating to timber production, such as wood volume or basal area. Disease effects are now assessed on a wider range of resource values including wildlife, recreation, and timber. Silvicultural prescriptions can be selected to reduce the impact dwarf mistletoe infection has on achieving resource objectives. The greater the infection level, the fewer treatment options available.

In lightly to moderately infected stands, even-aged stand conditions are often advised in timber producing blackjack (VSS3) areas in order to slow the spread of disease (i.e., mistletoe spreads more slowly on even aged trees growing on good quality sites). Where wildlife is emphasized and growth impacts are not a major concern, more mistletoe can exist without detrimental effects on desired conditions. Lightly to moderately infected stands can be thinned, depending on the age and structure of the stand, without impacts to timber or wildlife resources.

Multi-storied stands with heavy infection levels are either regenerated or deferred, depending on management objectives and degree across the landscape. Although spread of infection from an overstory seed source to newly established regeneration is the most rapid it is preventable if infected overstory trees are removed before infection takes place. Followup treatments are necessary in order to catch latent infections.

Proposed Prescriptions

Although the primary objective of the Eastside Fuel Reduction and Forest Health Project is to reduce the risk of fire in the wildland urban interface, treatment prescriptions are centered on following guidelines for the Mexican spotted owl and northern goshawk. Stand 297-01 is proposed to receive the Restricted Treatment, which follows the Mexican spotted owl recovery plan guideline of maintaining at least 40% canopy cover. This stand will receive a very light thinning of mostly small diameter trees. This treatment is not expected to reduce the effects of dwarf mistletoe infection on residual trees, but neither is it expected to increase the spread rate of infection. Young trees in heavily infected areas are not expected to become the future yellow pines, but young trees in uninfected areas will be candidates provided activities take place in the future that would keep infection levels low enough to allow growth and survival (e.g. more aggressive thinning or prescribed burning).

Stand 297-02 is prescribed to receive a Mechanical Treatment, which follows the northern goshawk guidelines. In this stand 40% canopy cover must only be maintained within the group or clump level and entire stand closure is about 20%. This treatment will allow for more targeted removal of dwarf mistletoe infected trees, reducing infection levels and allowing for reduced competition for water and nutrients that aids the health of residual trees.

The removal of conifers around aspen clones will aid in maintaining aspen on this site, but fencing will be needed to prevent browsing.

/s/ Mary Lou Fairweather
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cc: John Anhold
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